

Receding Waters



LESSON OVERVIEW

Students discuss adaptations of Arizona frogs and toads and participate in a simulation activity to demonstrate how a small receding (ephemeral) pool impacts the life cycle of certain amphibians.

SUGGESTED GRADE LEVELS

- K – 7

ENDURING UNDERSTANDINGS

- Animals are adapted to survive in the environment in which they live.
- Ecosystems change over time due to natural and human events.
- All living things have a life cycle that ends with the death of the organism.
- Population sizes are dependent on a variety of environmental factors such as climate, predation, and species competition.
- Human activities can affect the potential for hazards.

OBJECTIVES

Students will:

- Identify physical and behavioral adaptations of amphibians.
- Describe the concept of limiting factors.
- Identify factors that limit the number of tadpoles in a pond.
- Explain why many tadpoles do not survive to adulthood.

ARIZONA DEPARTMENT OF EDUCATION STANDARDS

Grade	Science
K	S4-C3-O2; S4-C3-O3
1	S1-C2-O4; S4-C3-O3
2	S1-C2-O4; S1-C3-O1; S4-C2-O3
3	S1-C2-O5; S1-C3-O1; S4-C3-O4; S4-C3-O5

Grade	Science
4	S1-C2-O5; S1-C4-O2; S3-C1-O1; S3-C1-O2
5	S1-C2-O5; S1-C4-O2; S3-C1-O1
6	S1-C2-O5; S1-C4-O1; S4-C1-O1; S4-C3-O2
7	S1-C2-O5; S1-C4-O1; S4-C3-O2; S4-C3-O3; S4-C3-O5; S4-C3-O6

Note: The full text of these standards can be found in Appendix A.

TIME FRAME

- 1 day (30 – 45 minutes)



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MATERIALS

- *A Field Guide to Amphibians and Reptiles of Maricopa County* (or similar field guide) or *Eyewitness Books – Amphibians*
- 100 feet clothesline or rope
- Several clip-on clothespins
- 2 inch squares on cardboard

TEACHER PREPARATION

- Tie the two ends of the rope together to form a large loop.
- Lay the loop on the ground to form a pond. Remember: The pond is ephemeral so it does not have to be a perfect circle.
- Write a number (1, 2, or 3) on each small square. Make an equal number of each one. The total of the numbers should be at least one less than the number of students.
- Place the squares facedown, randomly throughout the pond.
- Choose three to five students (depending on the size of the class) to be predators.

SUGGESTED PROCEDURES

1. Using references on amphibians, students (individually or in small groups) research adaptations of toads and frogs. Based upon their research, discuss the importance of water (quality and quantity) to, and challenges (predation, starvation, receding ponds, limited resources) faced by, tadpoles.
2. Activity: re-enact the metamorphosis of a tadpole. Using approximately 100 feet of rope tied together to create one continuous circle, “outline” the perimeter of an ephemeral pond. (Remember that water will collect in any depression and is not always the same depth – nor is it a perfect circle. The rope should represent a typical pond in nature: wide at some places, narrow at others.)
3. Three to five students (depending on the size of the group) remain outside the pond and will be the predators (herons, raccoons, others they discovered in their research). As predators, they may move around the pond and reach into the pond to touch a tadpole, but they may not enter the pond. Any tadpoles they touch will be eliminated, but only one tadpole per predator may be “eaten” in each round.
4. All other students will be inside the pond and represent spadefoot toad tadpoles. Their goal is to find adequate resources over successive rounds in order to survive: Those who gather three or more points in each round will survive; those with fewer than three points “die” and leave the pond. “Dead” tadpoles must sit out the remainder of the activity and may not interfere with the predators. (In the wild, dead tadpoles become food for scavengers such as coyotes, ravens, and others.)
5. At the beginning of each round, the teacher will distribute resources by tossing the 2 inch squares randomly, facedown into the pond. For each round, there should be one less square than there are tadpoles. (This will ensure that at least one tadpole is eliminated due to starvation each round.) Keep track of the number of tadpoles for each round and any special conditions that might have transpired (see #7 below).



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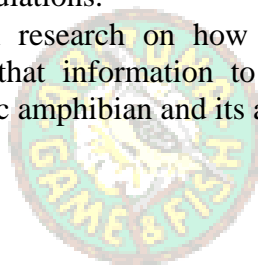
6. At the end of each round, the resource cards are collected and will be redistributed into the pond. Tadpoles must remain where they are at the end of each round and cannot move until the next round begins.
7. Overlap the rope approximately 10 feet in each subsequent round. Thus, the pond will get smaller and smaller due to events such as evaporation or wildlife quenching their thirst. (Suggestion: Portions of the pond that are shallower or exposed more directly to sunshine may dry up completely. Represent those factors by clipping together the rope at one or more points. Even though resources in their section of the pond may become scarce, and another section of the original pond may still have resources, tadpoles become “trapped” in one portion and may **not** cross into another section of the pond.)
8. At a minimum, the game will last four rounds. Once several students have been eliminated and/or several rounds have been played, you may choose to add one or both of the following:
 - a. A “monsoon round” in which the pond is enlarged and the resource points are abundant. (Consider allowing those tadpoles that did not survive in previous rounds to rejoin those in the pond at this time, representing a successful reproductive year for spadefoot toads.)
 - b. Students that have been eliminated become a herd of animals or OHV (Off Highway Vehicles), which go aimlessly through the pond and eliminate tadpoles (i.e., tadpoles must escape the vehicle or large animal, and may get close enough to the edge to be picked off by a predator).
9. Students (individually or in small groups/teams) graph or visually represent the total number of tadpoles surviving in each round.

ASSESSMENT

- List three or more physical and behavioral adaptations of amphibians.
- Identify environmental factors that can affect populations of amphibians.
- Explain the importance of ephemeral ponds to wildlife in the arid Southwest.
- List several factors that cause desert pools to recede.
- Compare and contrast the concepts of competition for resources and limiting factors.
- List several reasons why many tadpoles never make it through metamorphosis.
- Identify potential impacts of human activity upon populations of amphibians.

EXTENSIONS

- Students may keep a log or T-chart of how many students were eliminated in each round and how they were eliminated. Students can use this information to perform various calculations.
- Students may perform research on how other amphibians adapt to their environment and use that information to create an essay, book, chart or drawing about a specific amphibian and its adaptations.



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Appendix A: Arizona Department of Education Standards – Full Text

Science Standards

Grade	Strand	Concept	Performance Objective
K	4	3 – Organisms and Environments	2 – Identify that plants and animals need the following to grow and survive: <ul style="list-style-type: none"> • Food • Water • Air • Space
			3 – Describe changes observed in a small system (e.g., ant farm, plant terrarium, aquarium)
1	1	2 – Scientific Testing (Investigating and Modeling)	4 – Record data from guided investigations in an organized and appropriate format (e.g., lab book, log, notebook, chart paper)
	4	3 – Organisms and Environments	3 – Describe how plant and animals within a habitat are dependent on each other.
2	1	2 – Scientific Testing (Investigating and Modeling)	4 – Record data from guided investigations in an organized and appropriate format (e.g., lab book, log, notebook, chart paper)
		3 – Analysis and Conclusions	1 – Organize data using graphs (i.e., pictograph, tally chart), tables, and journals
	4	2 – Life Cycles	3 – Compare the life cycles of various organisms
3	1	2 – Scientific Testing (Investigating and Modeling)	5 – Record data in an organized and appropriate format (e.g., t-chart, table, list, written log)
		3 – Analysis and Conclusions	1 – Organize data using the following methods with appropriate labels: <ul style="list-style-type: none"> • Bar graphs • Pictographs • Tally charts
	4	3 – Organisms and Environments	4 – Describe how plants and animals cause change in their environment 5 – Describe how environmental factors (e.g., soil composition, range of temperature, quantity and quality of light or water) in the ecosystem may affect a member organism's ability to grow, reproduce, and thrive



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Science Standards Continued

Grade	Strand	Concept	Performance Objective
4	1	2 – Scientific Testing (Investigating and Modeling)	5 – Record data in an organized and appropriate format (e.g., t-chart, table, list, written log)
		4 – Communication	2 – Choose an appropriate graphic representation for collected data: <ul style="list-style-type: none"> • Bar graph • Line graph • Venn diagram • Model
	3	1 – Changes in Environments	1 – Describe how natural events and human activities have positive and negative impacts on environments (e.g., fire, floods, pollution, dams) 2 – Evaluate the consequences of environmental occurrences that happen either rapidly (e.g., fire, flood, tornado) or over a long period of time (e.g., drought, melting ice caps, the greenhouse effect, erosion)
5	1	2 – Scientific Testing (Investigating and Modeling)	5 – Record data in an organized and appropriate format (e.g., t-chart, table, list, written log)
		4 – Communication	2 – Choose an appropriate graphic representation for collected data: <ul style="list-style-type: none"> • Bar graph • Line graph • Venn diagram • Model
	3	1 – Changes in Environments	1 – Explain the impacts of natural hazards on habitats (e.g., global warming, floods, asteroid or large meteor impacts)
6	1	2 – Scientific Testing (Investigating and Modeling)	5 – Keep a record of observations, notes, sketches, questions, and ideas using tools such as written and/or computer logs
		4 – Communication	1 – Choose an appropriate graphic representation for collected data: <ul style="list-style-type: none"> • Line graph • Double bar graph • Stem and leaf plot • Histogram
	4	1 – Structure and Function in Living Systems	1 – Explain the importance of water to organisms

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Science Standards Continued

Grade	Strand	Concept	Performance Objective
6	4	3 – Populations of Organisms in an Ecosystem	2 – Describe how the following environmental conditions affect the quality of life: <ul style="list-style-type: none"> • Water quality • Climate • Population density • Smog
7	1	2 – Scientific Testing (Investigating and Modeling)	5 – Keep a record of observations, notes, sketches, questions, and ideas using tools such as written and/or computer logs
		4 – Communication	1 – Choose an appropriate graphic representation for collected data: <ul style="list-style-type: none"> • Line graph • Double bar graph • Stem and leaf plot • Histogram
	4	3 – Populations of Organisms in an Ecosystem	2 – Explain how organisms obtain and use resources to develop and thrive in: <ul style="list-style-type: none"> • Niches • Predator/prey relationships 3 – Analyze the interactions of living organisms with their ecosystems: <ul style="list-style-type: none"> • Limiting factors • Carrying capacity 5 – Predict how environmental factors (e.g., floods, droughts, temperature changes) affect survival rates in living organisms 6 – Create a model of the interactions of living organisms within an ecosystem

